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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

ED 062417

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

LOOM FIXER (textile) 4-16.010

B-417 or S-153

ED 062417

U. S. Employment Service in
Cooperation with
North Carolina State Employment Service

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
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GATB #864
August 1958

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR LOOM FIXER 4-16.010

B-417 or S-153

Summary

The General Aptitude Test Battery, B-1001, was administered to a sample of 50 men employed as Loom Fixer 4-16.010 by two plants of Klopman Mills, Incorporated, located at Asheboro and Central Falls, North Carolina. The criterion consisted of supervisory ratings made on a descriptive rating scale. On the basis of mean scores, correlations with the criterion, job analysis, and their combined selective efficiency, the Aptitudes N-Numerical Aptitude, P-Form Perception, and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Loom Fixer 4-16.010 - B-417 or S-153

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Loom Fixer 4-16.010.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-417 or S-153

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
N	CB-1-D CB-1-I	75	N	Part 2 Part 6	70
P	CB-1-A CB-1-L	75	P	Part 5 Part 7	75
M	CB-1-M CB-1-N	75	M	Part 9 Part 10	75

Effectiveness of Norms

The data in Table IV indicate that 14 of the 17 poor workers, or 82 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 82 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 29 of the 32 workers who made qualifying test scores, or 91 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Loom Fixer 4-16.010.

II. Sample

The GATB, B-1001, was administered in July 1958 to 55 male workers employed by two plants of Klopman Mills; 25 at the Asheboro plant and 30 at the Central Falls plant. In each plant, Loom Fixers are selected mainly from employees within the plants who are put on a training program. Trainees are selected on the basis of work record, pre-employment aptitude test, education, attitude, and cooperation. Five of the tested workers were eliminated from the sample because they had less than a sixth grade education and it appeared that this was the reason for their low test scores. All workers included in the sample were considered to be experienced workers. The final experimental sample consisted of 50 male workers.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

Loom Fixer 4-16.010
N = 50

	M	σ	Range	r
Age (years)	39.2	8.7	24-63	-.324*
Education (years)	8.6	2.1	6-12	.039
Experience (months)	127.8	87.4	4-734	-.160

* Significant at the .05 level

There are no significant correlations between education or experience and the criterion. The negative correlation between age and the criterion may indicate a bias on the part of the supervisors in favor of the younger workers or it may indicate that the younger workers tend to be more proficient on the job. The data in Table II indicate that this sample is suitable for test development purposes with respect to age, education, and experience.

III. Job Description

Job Title: Loom Fixer 4-16.010

Job Summary: Maintains textile looms in efficient operating condition, adjusting and repairing loom mechanisms and replacing worn or defective parts, and sets up looms to weave a specific pattern or grade of cloth.

Work Performed: Sets up loom for weaving a specific pattern or grade of cloth: Positions warp beam, harness, drop wire, and reed on loom and secures them in operating position by tightening nuts, bolts, and clamps. Installs appropriate gears to control speed of warp yarn in loom to correspond to number of filling threads specified in pattern. Makes trial run, checking all loom operating parts to see that they are synchronized.

Adjusts or repairs malfunctioning parts of loom: Receives report from Cloth Inspection Department on defects, such as jerked in or kinky fillings, wavy cloth, broken picks, uneven (heavy or light) weave. Observes and listens to operation of loom to locate cause of defect; makes adjustments, such as loosening or tightening set screws and repositioning cams on cam shaft for correct timing of picker or harness movements; shortens or lets out harness straps; cleans and tightens set screws of warp let-off mechanism to produce uniform release of warp in correcting uneven weave.

Checks all looms periodically for worn or broken parts; dismantles and repairs or replaces such parts as pickers, harness straps, gears, sprockets, shafts, using wrenches and other hand tools. Lubricates bearings of new parts and installs them in correct operating positions; starts loom and observes its operation, making any necessary adjustments for proper functioning of parts.

May train and/or supervise Learner Fixer, Warp Hanger, Loom Cleaner or other lesser skilled workers assisting in the maintenance of textile looms.

IV. Experimental Battery

All the tests of the GATB, B-1001, were administered to the sample group.

V. Criterion

The criterion consisted of supervisory ratings based on the Descriptive Rating Scale developed by the Bureau of Employment Security, Form SP-21. Workers at the Asheboro plant were rated by 14 supervisors and those at the Central Falls plant by 10 supervisors. The ratings were completed August 10, 1958. After each worker had been rated by his foreman, all ratings were considered in a conference conducted by the plant superintendents. The superintendent in each plant was in complete agreement with the ratings made by the foremen.

VI. Statistical and Qualitative Analyses

A. Statistical Analysis:

Table III shows the means, standard deviations, and Pearson product-moment correlations with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Loom Fixer 4-16.010
N = 50

Aptitudes	M	σ	r
G-Intelligence	89.7#	15.1	.328*
V-Verbal Aptitude	84.8	13.8	.215
N-Numerical Aptitude	86.2	17.8	.365**
S-Spatial Aptitude	95.2#	17.1	.241
P-Form Perception	86.2	16.9	.303*
Q-Clerical Perception	71.7	15.2	.297*
A-Aiming	85.7	20.7	.338*
T-Motor Speed	80.4	17.9	.382**
F-Finger Dexterity	97.2#	16.1	.236
M-Manual Dexterity	101.9#	18.5	.156

** Significant at the .01 level
* Significant at the .05 level
# Relatively high mean score

The highest mean scores in descending order of magnitude were obtained for Aptitudes M, F, S, and G, respectively. All the aptitudes, except Aptitude A, have standard deviations of less than 20. Aptitudes G and Q have the lowest standard deviations.

For a sample of 50 cases, correlations of .361 and .279 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes N and T correlate significantly with the criterion at the .01 level. Aptitudes G, P. Q, and A correlate significantly with the criterion at the .05 level.

B. Qualitative Analysis:

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Intelligence (G) - required to determine causes of malfunctioning machines; to solve mechanical problems; to set up machines for new patterns.

Numerical Aptitude (N) - required to calculate speed of loom needed to produce necessary number of picks and to calculate the gear ratios necessary to produce this speed.

Spatial Aptitude (S) and Form Perception (P) - required to set up loom for weaving a specific pattern or grade of cloth; to install appropriate gears to control speed; to check all loom operating parts to see that they are synchronized.

Finger Dexterity (F) and Manual Dexterity (M) - required to adjust screws and levers, install gears, tighten bolts, and to repair and replace various mechanical parts of the machines.

C. Selection of Test Norms:

Based on the quantitative and qualitative evidence cited above, Aptitudes G, N, S, P, F, and M warranted further consideration for inclusion in the test norms. The evidence for each of these aptitudes is indicated below.

Aptitude	Relatively High Mean Score	Significant Correlation with the Criterion	Importance Indicated by Qualitative Analysis
G	X	X	X
N		X	X
S	X		X
P		X	X
F	X		X
M	X		X

Although Aptitudes Q, A, and T showed significant correlations with the criterion, these aptitudes were not considered further for inclusion in the norms because there was no other qualitative or quantitative evidence of significance.

Various combinations of Aptitudes G, N, S, P, F, and M, with appropriate cutting scores were selected as trial norms. The relationship between each set of trial norms and the criterion (dichotomized as indicated in section VII) was determined.

A comparison of the results showed that B-1001 norms consisting of N-75, P-75, and M-75 had the best selective efficiency.

In test development studies an attempt is made to develop a set of norms such that the cutting score for each aptitude included in the norms will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In this study the aptitude cutting scores are each within 8 points of one standard deviation below the aptitude mean of the sample.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized by placing approximately one-third of the sample in the low criterion group. This was accomplished by using a descriptive rating scale score of 31 as the criterion critical score, and resulted in 17 of the 50 workers, or 34 percent of the sample, being placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes N, P, and M each with a critical score of 75 and the dichotomized criterion for Loom Fixer 4-16.010. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes N, P, and M Each with a Critical Score of 75 and the Criterion for Loom Fixer 4-16.010

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	4	29	33
Poor Workers	14	3	17
Total	18	32	50

$r_{tet} = .90$ $\qquad$ $X^2 = 21.069$

$\sigma_{r_{tet}} = .23$ $\qquad$ $P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes N, P, and M each with a minimum score of 75, are recommended as B-1001 norms for the occupation of Loom Fixer 4-16.010. The equivalent B-1002 norms consist of N-70, P-75, and M-75.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include the same three aptitudes

with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. Since none of the existing 23 occupational aptitude patterns includes Aptitudes N, P, and M, the selective efficiency of any existing occupational aptitude pattern was not determined for this sample. However, the data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.